

Biology as Inspiration for Nanoscale Materials Property Tuning

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Abstract – Nature is expert in using biomolecules to control the structure and properties of biominerals that are built from nanosized particles. Properties which can be regulated include composition, crystal phase, morphology, mechanical and optical behaviour among others. Biomolecules, including proteins and carbohydrates are central to this control where materials are generated appropriate for the lived environment and function. In this talk, I will briefly review how nature controls material properties and show how our understanding of this approach can be used to identify simpler biomolecules for use in materials tuning at the nanoscale. Using examples from research carried out in my research group I will show how the properties of metal nanoparticles can be manipulated for application either alone or as a component of a composite for a range of potential biomedical and technology applications. I will show how biomolecules can be used to moderate defect structures in semiconductor oxides, promote nucleation and crystallization in framework materials and additionally show how biomolecules extracted from biomineralized tissues can be used to generate unexpected crystalline phases. Knowledge of interactions at the molecular level serves to increase our understanding of the abiotic (mineral)-biotic (biomolecule) interface which will ultimately lead to better control of properties and wider application of nanosized materials.